Heavy Ion Physics Programme in CMS*

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General Introduction

This report presents the physics capabilities of the CMS detector with heavy ion beams. The primary goal of the heavy ion physics programme is to study the plasma of quarks and gluons (QGP). One of the strongest signatures proposed for its evidence is the heavy quark vector meson suppression. CMS is particularly well suited to study the Υ family and to a lesser extent the J/ψ and ψ'. Detection of the $Z^0 \to \mu^+\mu^-$ produced at the same impact parameter will provide a good reference to estimate the suppression as long as teh point-like Z^0 boson remains unchanged even at the very high energy densities expected to be reached at the LHC. Hard jet production is another probe of the formation of such a dense state of matter. The energy lost by the parton in traversing dense matter leads to quenching, *i.e.* suppression of high p_T jets. The dijet quenching and enhancement of the monojet/dijet ratio as well as the study of jets in the Z^0+jet and γ+jet channels will be investigated. The centrality of the collision can be determined from the transverse energy production measured over a wide rapidity range, up to $\eta < 5$. In addition to thse signals of dense matter production in central collisions, peripheral collisions can be used to look for new physics. The coherent photon field surrounding the nucleus leads to high luminosities for $\gamma\gamma$ interactions which can be used to study exotic particle production such as the structure of the Pomeron in diffractive processes.

The CMS detector has been designed with the following useful properties. The high magnetic field leads to a compact detector, with the first absorber, the electromagnetic calorimeter, at a distance of 1.3 m from the interaction point, allowing the elimination of a large fraction of the hadronic background. The very powerful tracking system, recently upgraded by the coice of silicon strip detectors, will provide a good track reconstruction efficiency for dimuons even for the extreme charged particle densities expected ($dN/dy \leq 8000$) and an excellent momentum resolution.

Although CMS has significant capabilities to investigate some heavy ion physics issues, CMS is clearly not a dedicated heavy ion experiment. Many signatures required for a complete QGP study cannot be explored. Therefore CMS can be seen as complementing the general purpose heavy ion detector.

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